Geophysical Research Abstracts, Vol. 8, 07612, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07612

Seismic wavefield inversion and imaging of the San Andreas Fault at SAFOD

F. Bleibinhaus(1,4), J.A. Hole(1), T. Ryberg(2), G.S. Fuis(3)

(1) Virginia Tech, USA (2) GeoForschungsZentrum Potsdam, Germany (3) USGS, Menlo Park, USA (4) Dept. of Earth and Environmental Sci., Univ. Munich, Germany

A 46 km long 2D seismic reflection and refraction survey across the San Andreas Fault (SAF) near Parkfield provides a detailed characterization of the upper crustal structure at the location of the San Andreas Fault Observatory at Depth (SAFOD). We present results from Kirchhoff prestack migration and from waveform tomography of these data. An initial p-wave velocity model down to 4 km depth was derived by travel time tomography. It contains a strong vertical and lateral contrast between the velocities of the Salinian terrane (˜6 km/s) to the SW and the Franciscan and Great Valley Sequences (2-4 km/s) to the NE of the SAF. Subsequent inversion of the acoustic wavefield for velocities was carried out in the frequency domain. Amplitudes were normalized because the observed amplitudes could not be modelled with sufficient accuracy, partially due to Q-variations from ˜1 to $>$1000. Weighting factors were computed on the basis of the semblance of the first-breaks to minimize the influence of noise. Our results show that the phase information alone provides enough information to significantly improve the resolution of the velocity model. However, complicated secondary phases caused by strong heterogeneities limit the reconstruction capacities of the inversion, particularly where the basement is shallow. Reflection seismic imaging focuses on steep dips in the upper crust. An outstanding vertical reflector at 0.5 - 2 km depth, ˜ 300 m offset to the NE from the surface trace of the SAF, is interpreted to form the NW boundary of a broad fault zone formed by multiple fault strands. About 1.6 km SW of the fault, a series of diffuse reflections indicates the edge of the Salinian terrane. Another subvertical reflector at 2 - 4 km depth 8 km to the NE of the SAF indicates the boundary between the Franciscan accretionary sediments and the Great Valley Sequence. Its bended shape is interpreted to be the result of transpressional forces related to the plate motions.